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FORM PTO-1390 REV. 5-93 — US DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE	ATTORNEYS DOCKET NUMBER **P01,0019**
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371	U.S.APPLICATION NO. (if known, see 37 CFR 1.5) 09/787398

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/02995	17 September 1999	18 September 1998

TITLE OF INVENTION
"BUS SYSTEM FOR TRANSMITTING OPTICAL SIGNALS"

APPLICANT(S) FOR DO/EO/US
Werner KRÜGER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).)
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C.371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report)**.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification and a marked up version of the specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
    a. ☐ Submittal of Drawings
    b. ☒ **EXPRESS MAIL #EL 655301077 US, dated March 16, 2001.**

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/787398	INTERNATIONAL APPLICATION NO. PCT/DE99/02995	ATTORNEY'S DOCKET NUMBER P01,0019

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				CALCULATIONS	PTO USE ONLY
17. ☒ The following fees are submitted: **BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):** Search Report has been prepared by the EPO or JPO . . . . $860.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) . . $700.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) . . . . $770.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO . . . . $1040.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) . . . . $ 96.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	17 - 20 =		X $ 18.00	$ .00	
Independent Claims	1 - 3 =	1	X $ 80.00	$	
Multiple Dependent Claims			$270.00 +	$	
TOTAL OF ABOVE CALCULATIONS =				$ 860.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)				$	
SUBTOTAL =				$ 860.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 860.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +					
TOTAL FEES ENCLOSED =				$ 860.00	
				Amount to be refunded	$
				charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ________ in the amount of $ ______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 501519. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

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IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

"**PRELIMINARY AMENDMENT**"

APPLICANT: Werner KRÜGER

SERIAL NO.: EXAMINER:

FILING DATE: ART UNIT:

INTERNATIONAL APPLICATION NO.: PCT/DE99/02995

INTERNATIONAL FILING DATE: 17 September 1999

INVENTION: BUS SYSTEM FOR TRANSMITTING OPTICAL SIGNALS

Hon. Assistant Commissioner for Patents
Box PCT
Washington D.C. 20231

SIR:

Amend the above-identified international application before entry into the national stage before the U.S. Patent & Trademark Office under 35 U.S.C. §371 as follows:

IN THE SPECIFICATION

Please substitute the specification in the file with the enclosed substitute specification in compliance with 37 CFR 1.125(b). Furthermore, a separate marked up copy of the specification that shows all changes relative to the previous specification is also enclosed.

IN THE CLAIMS

Please cancel all claims without prejudice and add new claims 17-33 as follows.

WE CLAIM:

17. A telephone device for transmission of optical signals, comprising:

a first component;

a first body that includes at least one of a light emitting element and a light receiving element, a first plurality of interfaces for at least one of an input and an output of signals, said first body being optically conductive, the first component being coupled to the first body;

a second component;

a second body that includes at least one of a light emitting element and a light receiving element, a second plurality of interfaces for at least one of an input and an output of signals, said second body being optically conductive, the second component being coupled to the second body;

the first body and the second body being arranged on top of one another as to form a bus system, the first body and the second body being movable relative to one another and in optical contact with one another,

said first body having an optical conductivity and the second body having an optical conductivity such that an optical signal input at any one of the first plurality and the second plurality of interfaces is capable of being coupled at another one of the first plurality and the second plurality of interfaces, regardless of a position of an interface.

18. A telephone device according to claim 17, wherein the first component is being provided in an upper shell and the second component is being provided in a lower shell.

19. A telephone device according to claim 18, wherein the upper shell and the lower shell are being connected only via a guide device, said guide device permits a relative motion of the lower shell with respect to the upper shell.

20. A telephone device according to claim 19, wherein the guide device is being fashioned as to enable at least one of a displacement and a turning and a hinging of the upper and the lower shell relative to one another.

21. A telephone device according to claim 17, wherein the bus system is formed of the first body and the second body, each of the first body and the second body having a cuboid shape, the first body and the second body being cast from an optically conductive material, the first body and the second body form a lower shell and an upper shell.

22. A telephone device according to claim 17, wherein the first component includes a keyboard and a microphone.

23. A telephone device according to claim 17, wherein the second component includes a display and an earphone.

24. A telephone device according to claim 17, wherein the first body and the second body are at least one of movably layered as to one another and arranged on top of one another with:

(a)- the first body and the second body completely overlap provided that one of an off condition and a stand by condition is set, and;

(b)- the first body and the second body do not completely overlap provided that an on condition is set.

25. A telephone device according to claim 17, wherein the first component is arranged within the first optically conductive body and the second component is arranged within the second conductive body.

26. A telephone device according to claim 17, wherein the first component includes a signal input device and the second component includes a signal output device.

27. telephone device according to claim 17, wherein further optically conductive bodies are coupled to the bus system, said conductive bodies include at least one of a light-emitting and light-receiving element.

28. A telephone device according to claim 17, wherein interfaces of the bus system for at least one of an input and output signals are being situated in one of an inside and an exterior of the first body and the second body.

29. A telephone device according to claim 17, wherein the first body and the second body are being formed of a material that conducts light in at least one of an infrared range and a visible range and an ultraviolet range.

30. A telephone device according to claim 17, wherein a respective component is being equipped with an opto-electronic component that converts electrical signals in to optical signals and an opto-electronic component that converts optical signals in to electrical signals.

31. A telephone device according to claim 17, wherein energy and data are being transmitted as optical signals via the bus system.

32. A telephone device according to claim 17, further comprising: a solar cell for an energy supply of the first component and the second component with an assistance of the bus system, said solar cell converting a part of energy situated in the bus system as a result of a transmitted optical signal in to an operating current.

33. A telephone device according to claim 17, wherein said telephone device is at least one of a telephone set and a telephone receiver and a mobile radio-telephone device.

REMARKS

The foregoing amendments to the specification and claims under Article 41 of the Patent Cooperation Treaty place the application into a form for prosecution before the U.S. Patent and Trademark Office under 35 U.S.C. §371. Accordingly, entry of these amendments before examination on the merits is hereby requested.

Respectfully submitted,

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ATTORNEY FOR APPLICANT

Sub-Spec.

09/787398

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SPECIFICATION

TITLE

TELEPHONE SET, TELEPHONE RECEIVER OR MOBILE RADIOTELEPHONE DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a radio/telephone system for transmission of optical signals via two optically conductive bodies that form a bus system.

Description of the Related Art

Optical bus systems serve for the communication between opto-electronic assemblies and are traditionally formed of a bundle of light guides or optical fibers arranged parallel to one another. The input and/or output of the optical signals to be transmitted or received by the assemblies thereby ensues at an interface formed at the start or end of the bundle of light guides. In the normal case, a bundle of light guides produces the connection between two assemblies that are respectively arranged at the ends of the bundle of light guides. When, however, a plurality of assemblies are to be arranged at an end of the bundle, the bundle must be split into a corresponding plurality of sub-bundles at the end. The splitting of the bundle of light guides into a specific plurality of sub-bundles represents a complicated procedure. Since the individual light guides or optical fibers are insulated from one another - (i.e. a signal transmission does not ensue from one light guide onto another) - it is necessary to position the assemblies

exactly at the respective ends of the bundle or sub-bundle of light guides. Otherwise, a correct transmission of signal between the assemblies is not assured.

EP 0 249 746 merely discloses a single optical fiber for a data bus system that, on the basis of a light-dispersing lead proceeding coaxially in its inside, enables the input or output of light through its cladding layer at various locations of its longitudinal extent.

With the mounting arrangement of EP 0 237 237, a single optical conductor at a mounting plate can be brought such into a specific position that it can be coupled to a plurality printed circuit boards attached thereto for different configurations and thereby remains easily accessible for another printed circuit board arrangement, (for example by replacement or repositioning). For the respective, given printed circuit board arrangement, the optical conductor is thereby permanently arranged in one and the same position.

EP 0 266 934 merely discloses a manufacturing method for a light waveguide with a specific structure and preparation.

EP 0 366 974 A1 is merely directed to a semiconductor circuit wherein at least two optical connecting layers are optically coupled to at least one light waveguide via an optical printed circuit board. The at least two connecting layers and the light waveguides of the optical printed circuit board are thereby arranged in a permanently given, i.e. fixed spatial allocation and are permanently optically coupled to one another in this one given position.

SUMMARY OF THE INVENTION

The invention is based on the object of offering a telephone set, telephone receiver or a mobile radiotelephone device assemblies such that an optimally faultless transmission of optical signals is enabled between them.

The optical bodies of the bus system are arranged above one another or layered on top of one another such that they are movable relative to one another and thereby simultaneously remain in optical contact with one another, so that a largely faultless transmission of optical signals is always assured between the two components of the telephone set, telephone receiver or mobile radiotelephone device. In particular, both in the off and standby condition as well as in the on condition. Since the two components are coupled to the optically conductive bodies of the bus system that are movable relative to one another, it is not necessary to electrically connect them to one another, (for example with a flexible printed circuit board). Due to the superimposed arrangement or superimposed layering of the optical bodies, these can shift relative to one another often. Wear problems that could occur, for example, given an electrical connection of the two components with a flexible printed circuit board are thus largely avoided. Thus, the risk of degradations or even interruptions of the signal transmission between the two components can be largely avoided. Accordingly, a faultless transmission of optical signals, particularly of data and/or energy, between the components two - (for example, of a mobile radiotelephone device) - can be permanently achieved to a great extent.

Furthermore, a bus system is offered for the transmission of optical signals that comprises at least one optical conductive body. Optical signals of electrical assemblies are supplied to or taken from the body via predetermined interfaces. The structure of the optically conductive body is of such a nature that an optical signal input at an interface can be coupled out at any other interface regardless of its position. The delivery of the optical signals by the electrical assemblies can thereby ensue, via light-emitting diodes, laser diodes, etc., whereas the taking thereof can ensue, with photodiodes, solar cells and phototransistors or other opto-electronic components.

The bus system can, in particular, be fashioned as a plastic body when the optically conductive body is manufactured of a shapable material. Therefore, a plurality of interfaces for the input and/or output of optical signals in the inside of the optically conductive body can also be formed after fabrication of the optically conductive body by merely pressing corresponding components into the optical conductive body. In comparison, when the optically conductive body is formed of a non-shapable material, then a bus system having a fixed shape is created that advantageously has adequate resistance to mechanical stressing.

Further, transmission losses within the bus system can be minimized in that the respective optically conductive body is expediently formed of a material that conducts light in a directed fashion.

Advantageously, even low-energy signals can thus be transmitted. When, according to another development, in contrast, the optically conductive body is manufactured of a material that conducts light in undirected fashion, then the interfaces

via which optical signals are supplied to or taken from the bus system can be arbitrarily selected.

The optically conductive body can, further, be preferably formed of a material that particularly conducts light in the infrared range, in the visible range or in the ultraviolet range. Suitable materials are, in particular, plastics such as plexiglass, PVC, acrylic, as well as glass and light-transmissive liquids.

Interfaces for the input and/or output of optical signals can, for example, be particularly formed in a simple way in that the photoelements of the respective assemblies are either arranged in the inside of the optically conductive body and surrounded by it or the exterior surface of the optically conductive body -(to which the photoelements are attached)- is suitably prepared for and admission or output of light, for example by forming a surface structure that allows a partial input and/or output of light.

The optical contact between two optically conductive bodies can, in particular, be produced in a simple way in that the bodies are layered on one another or arranged on top of one another such that surface regions of the bodies overlap. The surface regions -- which are in turn suitably prepared for an entry or exit of light -- can thereby either touch one another or reside opposite one another at a distance to be defined. Since there is no fixed connection between the bodies, they can be shifted or, respectively, turned relative to one another.

When, according to another development, the two components are respectively arranged within an optically conductive body, a compact electrical device is created with contours that can be arbitrarily designed.

The inventive bus system can be advantageously employed in an electrical apparatus wherein the first component comprises a signal input device and the second component comprises a signal output device. For example, a telephone set, particularly a cell phone, or a telephone receiver can be formed, whereby the first component contains a keyboard and a microphone and is arranged in the first optically conductive body, and the second component contains a display and an earphone and is arranged in the second optically conductive body.

Further, an arbitrary plurality of further conductive bodies can be coupled to the inventive bus system, whereby each of the optically conductive bodies can comprise one or more light-emitting and/or light-receiving elements. Accordingly, arbitrarily large or high-performance bus system can thus be produced.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

According to the embodiment, the bus system is utilized in conjunction with a mobile wireless communication system, for example a mobile radiotelephone device according to the GSM standard.

The bus system is thereby formed by, for example, two bodies having a cuboid shape that are cast from an optically conductive material such as acrylic and form the lower shell and upper shell, i.e. the housing, of the mobile radiotelephone device. In

particular, a material is selected that is selectively transparent for infrared light and that conducts light in undirected fashion.

A first component is cast into the upper shell, this first component comprising, among other things, a first energy store to be supplied via the bus, a keyboard, a microphone, a first control circuit and -- as opto-electronic components (coupling elements) -- a light-emitting diode as well as a photodiode. Compared thereto, a second component is cast into the lower shell and comprises, among other things, an energy store to be supplied from the outside, a liquid crystal display, an earphone, a second control circuit and -- again as opto-electronic components -- a light-emitting diode as well as a photodiode. The components of the first and second component are electrically connected to one another in a suitable way, whereas the opto-electronic components are respectively in optical contact with the upper shell or lower shell. The respective components can be arbitrarily arranged within the upper shell and lower shell.

The upper and lower shell of the mobile radiotelephone device are directly layered on one another, whereby the sides lying opposite one another are matched to one another and are merely connected to one another by a guide device that allows a relative displacement of the lower shell with respect to the upper shell. In the off condition as well as in the standby condition of the mobile radiotelephone device, the sides of the upper and lower shell lying directly opposite one another overlap completely, whereas they partially overlap in the on condition. In both the off condition and in the standby condition as well as in the on condition, the upper shell and lower

shell are in optical contact with one another. As such, the optical contact is also maintained in the on condition, wherein the sides of the upper and lower shell lying directly opposite one another only partially overlap, the overlapping regions are fashioned such by formation of a suitable surface structure, for example by polishing, that light from the upper shell can proceed merely unimpeded into the lower shell and vice versa.

The transmission of signals between the respective components via the bus system ensues in that the first component converts electrical signals into optical signals with an opto-electronic component, the optical signals being supplied via an interface to a first optical conductive body of the bus system. The first optically conductive system transmits the optical signals onto a second optically conductive body that is in optical contact with the first body. A second component takes or receives the optical signals via an interface of the second optically conductive body with another opto-electronic component that converts the optical signals into electrical signals. A bidirectional transmission of signals is enabled in that the respective components are equipped both with an opto-electronic component that is suitable for the conversion of electrical signals into optical signals, such as a light-emitting diode, as well as with an opto-electronic component that is suitable for converting optical signals into electrical signals, such as a photodiode. Since the upper shell and lower shell are not electrically connected to one another, for example by a flexible printed circuit board, they can be moved arbitrarily often relative to one another without there being any risk of damaging the electrical connection.

The type of relative movement of the upper shell and lower shell relative to one another, i.e. a displacement, turning or hinging of the upper and lower shell relative to one another is thereby defined by the design of the guide device.

The optical signals transmitted by the bus system can, on the one hand, represent data, i.e. information. On the other hand, the optical signal can also represent energy that is needed by the respective component for offering an operating current or an operating voltage that is not supplied from the outside via an electrical conductor.

For components having very low power consumption, the energy supply via the bus system can, for example, ensue via a solar cell that converts a part of the energy situated in the bus system due to the transmitted optical signals into an operating current. In particular, the energy supply of an LCD can ensue in this way, the power requirements thereof only amounting to a few micro-amperes.

Specific circuit measures are required given components with a higher power consumption. Given, for example, a packet-oriented transmission of data, an energy store such as a capacitor, a coil, etc., can be charged with energy via the bus system. The effective data transmission rate is then defined, among other things, by the amount of energy available for the transmission of the individual data packets. The operation of a keyboard can ensue in this way.

The energy supply of acoustic components such as a microphone or an earphone requires a relatively high power consumption that is offered by a high-capacity

energy store such as, for example, an accumulator or a high-capacity capacitor, for example a “gold cap”.

In this embodiment, the energy supply of the mobile radiotelephone device overall and of the second component located in the lower shell ensues with the second energy store, which is fashioned as accumulator and is supplied or charged from the outside via a supply line. The energy supply of the first component situated in the upper shell, which comprises a microphone and thus has a relatively high power consumption, ensues with the first energy store, which is likewise fashioned as an accumulator or a high-capacity capacitor, for example a “gold cap”, but is supplied or charged via the bus system. Alternatively, the energy supply of the first component can ensue via an electrical line that is connected to the externally supplied energy store of the second component.

For protection against mechanical damage and for shielding external noise influences, the outsides of the upper shell and lower shell of the mobile radiotelephone device are provided with a light-impermeable coating.

Although other modifications and changes may be suggested by those skilled in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.

ABSTRACT OF DISCLOSURE

A telephone device for transmission of optical signals comprising two optically conductive bodies movably layered and flexibly arranged on top of one another as to form a bus system, such that an optical signal input at one interface can be coupled at any other interface regardless of the position thereof. Accordingly, a faultless transmission of optical signals is assured to a great extent. Furthermore, since components of a telephone set using this flexible bus systems are no loner in electrical contact, the wear problems associated with electrical contacts are eliminated.

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TELEPHONE SET, TELEPHONE RECEIVER OR MOBILE RADIOTELEPHONE DEVICE

Optical bus systems serve for the communication between opto-electronic assemblies and are traditionally formed of a bundle of light guides or, respectively, optical fibers arranged parallel to one another. The input and/or output of the optical signals to be sent or, respectively, to be received by the assemblies thereby ensues at an interface formed at the start or, respectively, end of the bundle of light guides. In the normal case, a bundle of light guides produces the connection between two assemblies that are respectively arranged at an end thereof. When, however, a plurality of assemblies is to be arranged at an end of the bundle, the bundle must be split into a corresponding plurality of sub-bundles at the end. The splitting of the bundle of light guides into a specific plurality os sub-bundles represents a complicated procedure. Since the inividual [sic] light guides or, respectively, optical fibers are insulated from one another, i.e. a signal transmission does not ensue from one light guide onto another, it is necessary to position the assemblies exactly at the respective ends of the bundle or, respectively, sub-bundle of light guides. Otherwise, a correct transmission of signal between the assemblies is not assured.

EP 0 249 746 merely discloses a single optical fiber for a data bus system that, on the basis of a light-dispersing lead proceeding coaxially in its inside, enables the input or, respectively, output of light through its cladding layer at various locations of its longitudinal extent.

With the mounting arrangement of EP 0 237 237, a single optical conductor at a mounting plate can be brought such into a specific position that it can be coupled to a plurality printed circuit boards attached thereto for different configurations and thereby remains easily accessible for another printed circuit board arrangement, for example by replacement or repositioning. For the respective, given printed circuit board arrangement, the optical conductor is thereby permanently arranged in one and the same position.

EP 0 266 934 merely discloses a manufacturing method for a light waveguide with a specific structure and preparation.

EP 0 366 974 A1 is merely directed to a semiconductor circuit wherein at least two optical connecting layers are optically coupled to at least one light waveguide via an optical printed circuit board. The at least two connecting layers and the light waveguides of the optical printed circuit board are thereby arranged in a permanently given, i.e. fixed spatial allocation and are permanently optically coupled to one another in this one given position.

The invention is based on the object of offering a telephone set, telephone receiver or a mobile radiotelephone device between whose respective assemblies an optimally faultless transmission of optical signals is enabled.

This object is achieved with the assistance of a telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, conforming to the features of claim 1.

In that the optical bodies of the bus system are arranged above one another or layered on top of one another such that they are movable relative to one another and thereby simultaneously remain in optical contact with one another, a largely faultless transmission of optical signals is always assured between the two components of the telephone set, telephone receiver or mobile radiotelephone device, particularly both in the off and standby condition as well as in the on condition. Since the two components are coupled to the optically conductive bodies of the bus system that are movable relative to one another, it is not necessary to electrically connect them to one another, for example with a flexible printed circuit board. Due to the superimposed arrangement or, respectively, superimposed layering of the optical bodies, these can relative to one another practically arbitrarily often. Wear problems that could occur, for example, given an electrical connection of the two components with a flexible printed circuit board are thus largely avoided. In this way, thus, the risk of degradations or even interruptions of the signal transmission between the two components can be largely avoided. In a simple way, thus, a faultless transmission of optical signals, particularly of data and/or energy, between the components of, for example, a mobile radiotelephone device can be largely permanently achieved.

Further, in particular, a bus system is offered for the transmission of optical signals that comprises at least one optical conductive body. Optical signals of

electrical assemblies are supplied to or, respectively, taken from the body via predetermined interfaces that occur multiply. The structure of the optically conductive body is of such a nature that an optical signal input at an interface can be coupled out at any other interface regardless of its position. The delivery of the optical signals by the electrical assemblies can thereby ensue, for example, via light-emitting diodes, laser diodes, etc., whereas the taking thereof can ensue, for example, with photodiodes, solar cells and phototransistors or other opto-electronic components.

The bus system can, in particular, be fashioned as a plastic body when the optically conductive body is manufactured of a shapable material. As a result thereof, a plurality of interfaces for the input and/or output of optical signals in the inside of the optically conductive body can also be formed after fabrication of the optically conductive body by merely pressing corresponding components into the optical conductive body. When, in comparison thereto, the optically conductive body is formed of a non-shapable material, then a bus system having a fixed shape is created that advantageously has adequate resistance to mechanical stressing.

Further, transmission losses within the bus system can be minimized in that the respective optically conductive body is expediently formed of a material that conducts light in directed fashion.

Advantageously, even low-energy signals can thus be transmitted. When, according to another development, in contrast, the optically conductive body is manufactured of a material that conducts light in undirected fashion, then the interfaces via which optical signals are supplied to or, respectively, taken from the bus system can be arbitrarily selected.

The optically conductive body can, further, be preferably formed of a material that particularly conducts light in the infrared range, in the visible range or in the ultraviolet range. Suitable materials are, in particular, plastics such as plexiglass, PVC, acrylic, as well as glass and light-transmissive liquids.

Interfaces for the input and/or output of optical signals can, for example, be particularly formed in a simple way in that the photoelements of the respective assemblies are either arranged in the inside of the optically conductive body and

surrounded by it or the exterior surface of the optically conductive body to which the photoelements are attached is suitably prepared for and admission or output of light, for example by forming a surface structure that allows a partial input and/or output of light.

The optical contact between two optically conductive bodies can, in particular, be produced in a simple way in that the bodies are layered on one another or, respectively, arranged on top of one another such that surface regions of the bodies overlap. The surface regions -- which are in turn suitably prepared for an entry or exit of light -- can thereby either touch one another or reside opposite one another at a distance to be defined. Since there is no fixed connection between the bodies, they can be shifted or, respectively, turned relative to one another.

When, according to another development, the two components are respectively arranged within an optically conductive body, a compact electrical device is created whose contour can be arbitrarily designed.

The inventive bus system can be advantageously employed in an electrical apparatus wherein the first component comprises a signal input device and the second component comprises a signal output device. For example, a telephone set, particularly a cell phone, or a telephone receiver can be formed, whereby the first component contains a keyboard and a microphone and is arranged in the first optically conductive body, and the second component contains a display and an earphone and is arranged in the second optically conductive body.

Further, an arbitrary plurality of further conductive bodies can be coupled to the inventive bus system, whereby each of the optically conductive bodies can comprise one or more light-emitting and/or light-receiving elements. And arbitrarily large or, respectively, high-performance bus system can thus be produced.

The inventive bus system is described below on the basis of a specific embodiment.

According to the embodiment, the bus system is shown in conjunction with a mobile wireless communication system, for example a mobile radiotelephone device according to the GSM standard.

The bus system is thereby formed by, for example, two bodies having a cuboid shape that are cast from an optically conductive material such as acrylic and form the lower shell and upper shell, i.e. the housing, of the mobile radiotelephone device. In particular, a material is selected that is selectively transparent for infrared light and that conducts light in undirected fashion.

A first component is cast into the upper shell, said first component comprising, among other things, a first energy store to be supplied via the bus, a keyboard, a microphone, a first control circuit and -- as opto-electronic components (coupling elements) -- a light-emitting diode as well as a photodiode. Compared thereto, a second component is cast into the lower shell and comprises, among other things, an energy store to be supplied from the outside, a liquid crystal display, an earphone, a second control circuit and -- again as opto-electronic components -- a light-emitting diode as well as a photodiode. The components of the first and second component are electrically connected to one another in a suitable way, whereas the opto-electronic components are respectively in optical contact with the upper shell or, respectively, lower shell. The respective components can be arbitrarily arranged within the upper shell and lower shell.

The upper and lower shell of the mobile radiotelephone device are directly layered on one another, whereby the sides lying opposite one another are matched to one another and are merely connected to one another by a guide device that allows a relative displacement of the lower shell with respect to the upper shell. In the off condition as well as in the standby condition of the mobile radiotelephone device, the sides of the upper and lower shell lying directly opposite one another overlap completely, whereas they partially overlap in the on condition. In both the off condition and in the standby condition as well as in the on condition, the upper shell and lower shell are in optical contact with one another. So that the optical contact is also maintained in the on condition, wherein the sides of the upper and lower shell lying directly opposite one another only partially overlap, the overlapping regions are

fashioned such by formation of a suitable surface structure, for example by polishing, that light from the upper shell can proceed merely unimpeded into the lower shell and vice versa.

The transmission of signals between the respective components via the bus system ensues in that the first component converts electrical signals into optical signals with an opto-electronic component, said optical signals being supplied via an interface to a first optical conductive body of the bus system. The first optically conductive system transmits the optical signals onto a second optically conductive body that is in optical contact with the first body. A second component takes or, respectively, receives the optical signals via an interface of the second optically conductive body with another opto-electronic component that converts the optical signals into electrical signals. A bidirectional transmission of signals is enabled in that the respective components [sic] is equipped both with an opto-electronic component that is suitable for the conversion of electrical signals into optical signals, such as a light-emitting diode, as well as with an opto-electronic component that is suitable for converting optical signals into electrical signals, such as a photodiode. Since the upper shell and lower shell are not electrically connected to one another, for example by a flexible printed circuit board, they can be moved arbitrarily often relative to one another without there being any risk of damaging the electrical connection.

The type of relative movement of the upper shell and lower shell relative to one another, i.e. a displacement, turning or hinging of the upper and lower shell relative to one another is thereby defined by the design of the guide device.

The optical signals transmitted by the bus system can, on the one hand, represent data, i.e. information, but, on the other hand, can also represent energy that is needed by the respective component for offering an operating current or, respectively, an operating voltage that is not supplied from the outside via an electrical conductor.

For components having very low power consumption, the energy supply via the bus system can, for example, ensue via a solar cell that converts a part of the energy situated in the bus system due to the transmitted optical signals into an

operating current. In particular, the energy supply of an LCD can ensue in this way, the power requirements thereof only amounting to a few micro-amperes.

Specific circuit measures are required given components with a higher power consumption. Given, for example, a packet-oriented transmission of data, an energy store such as a capacitor, a coil, etc., can be charged with energy via the bus system. The effective data transmission rate is then defined, among other things, by the amount of energy available for the transmission of the individual data packets. The operation of a keyboard can ensue in this way.

The energy supply of acoustic components such as a microphone or an earphone requires a relatively high power consumption that is offered by a high-capacity energy store such as, for example, an accumulator or a high-capacity capacitor, for example a “gold cap”.

In this embodiment, the energy supply of the mobile radiotelephone device overall and of the second component located in the lower shell ensues with the second energy store, which is fashioned as accumulator and is supplied or, respectively, charged from the outside via a supply line. The energy supply of the first component situated in the upper shell, which comprises a microphone and thus has a relatively high power consumption, ensues with the first energy store, which is likewise fashioned as accumulator or a high-capacity capacitor, for example a “gold cap”, but is supplied or, respectively, charged via the bus system. Alternatively, the energy supply of the first component can ensue via an electrical line that is connected to the externally supplied energy store of the second component.

For protection against mechanical damage and for shielding external noise influences, the outsides of the upper shell and lower shell of the mobile radiotelephone device are provided with a light-impermeable coating.

Patent Claims

1. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, for the transmission of optical signals, comprising a first component that is coupled to at least one first optically conductive body and comprises one or more light-emitting and/or light-receiving elements, and comprising a second component that is coupled to at least one second optically conductive body and comprises one or more light-emitting and/or light-receiving elements, whereby the first and the second optically conductive body are arranged above one another or layered on top of one another such upon formation of a bus system that they are movable relative to one another and are thereby in optical contact with one another, whereby the respective, optically conductive body of the bus system comprises a plurality of interfaces for the input and/or output of optical signals, and whereby the structure of the respective, optically conductive body is of such a nature that an optical signal input at one interface can be coupled out at any other interface regardless of the position thereof.

2. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to claim 1, characterized in that the first component is provided in an upper shell and the second component is provided in a lower shell.

3. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to claim 2, characterized in that the upper shell and the lower shell are only connected to one another by a guide device that allows a relative motion of the lower shell with respect to the upper shell.

4. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to claim 3, characterized in that the guide device is fashioned such that a displacement, turning or hinging of the upper and lower shell relative to one another is enabled.

5. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the bus system is formed by two bodies having a cuboid shape that are cast of an optically conductive material and form a lower shell and an upper shell.

6. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the first component comprises a keyboard and a microphone.

7. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the second component comprises a display and an earphone.

8. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the first and the second optical body are movably layered on top of one another or arranged above one another such that these completely overlap in the off and standby condition and partially overlap in the on condition.

9. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the first component is arranged essentially inside the first optically conductive body and the second component is arranged essentially within the second optically conductive body.

10. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the first component comprises a signal input device and the second component comprises a signal output device.

11. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that further optically conductive bodies are coupled to the bus system and the optically conductive bodies comprise one or more light-emitting and/or light-receiving elements.

12. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the interfaces of the bus system for the input and/or output of optical signals are situated in the inside or at the exterior surface of the optically conductive bodies.

13. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that

the optically conductive bodies are formed of a material that conducts light, particularly in the infrared range, in the visible range or in the ultraviolet range.

14. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that, for bidirectional transmission of optical signals, the respective component is equipped both with an opto-electronic component for the conversion of electrical signals into optical signals as well as with an opto-electronic component for the conversion of optical signals into electrical signals.

15. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that the optical bus system is fashioned such that data, on the one hand, as well as energy, on the other hand, can be transmitted as optical signals.

16. Telephone set, telephone receiver or mobile radiotelephone device, particularly cell phone, according to one of the preceding claims, characterized in that a solar cell is provided for the energy supply of the components with the assistance of the bus system, said solar cell converting a part of the energy situated in the bus system as a result of the transmitted, optical signals into an operating current.

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
ERKLÄRUNG FÜR PATENTANMELDUNGEN MIT VOLLMACHT
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

BUSSYSTEM ZUM ÜBERTRAGEN VON OPTISCHEN SIGNALEN

BUS SYSTEM FOR TRANSMITTING OPTICAL SIGNALS

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

(check one)

☐ hier beigefügt ist.

☐ is attached hereto

■ am 17 September 1999 als
PCT Internationale Anmeldung
PCT Anmeldungsnummer PCT/DE99/02995
eingereicht wurde und am 18 September 1998
abgeändert wurde (falls tatsächlich abgeändert)

■ was filed on ____________ as
PCT international application
PCT Application No. ____________
and was amended on ____________
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Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign applications
Priorität beansprucht

Priority Claimed

(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
198 42 815.4	Germany	18 September 1998	■	☐
			☐	☐

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122 I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

And I hereby appoint all Attorneys identified by United States Patent and Trademark Office customer number 26574, who are all members of the firm of Schiff Hardin and Waite.

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(Supply similar information and signature for subsequent joint inventors).